Hall Ticket No | | | | | | | | | | | Question Paper Code:AITC01

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Dundigal-500043, Hyderabad)

B.Tech III SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022

Regulation:UG-20

DISCRETE MATHEMATICAL STRUCTURES

Time: 3 Hours **(CSE|IT|CSIT)** **Max Marks: 70**

Answer ALL questions in Module I and II

Answer ONE out of two questions in Modules III, IV and V

NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. (a) Find the principal disjunctive normal forms of the statement:
   $P \wedge \urcorner(q \wedge r) \vee (p \rightarrow q)$ **[7M]**

   (b) Show that the premises "one student in this class knows how to write programs in JAVA" and "Everyone who knows how to write in this class can get a high-paying job". **[7M]**

MODULE – II

2. (a) If R is the relation on the set of integers such that $(a, b)\epsilon R$ if and only if $3a + 4b = 7n$ for some integer n, prove that R is an equivalence relation. **[7M]**

   (b) Draw the Hasse diagram representing the partial ordering $\{(A, B)|A \subseteq B\}$ on the power set P(S), where S={a,b,c} . Find the maximal, minimal, greatest and least elements of the poset. Find also the upper bounds and LUB of the subset ({a},{b},{c}) and the lower bounds and GLB of the subset ({a,b},{a,c}, {b,c}) . **[7M]**

MODULE – III

3. (a) If * is the binary operation on the set R of real numbers defined by $a * b = a + b + 2ab$. **[7M]**
   i) Find if {R,*} is a semigroup. Is it commutative?
   ii) Find the identity element, if exists
   iii) Which elements have inverses and what are they?

   (b) Prove that the set $Z_4 = \{0, 1, 2, 3\}$ is a commutative ring with respect to the binary operation $+_4$,$*_4$. **[7M]**

4. (a) If G is the set of all ordered pairs (a, b) where a(≠0) and b are real and the binary operation * on G is defined by $(a, b) * (c, d) = (ac, bc + d)$ show that (G,*) is a non-abelian group. Show also that the subset H of all those elements of G which are of the form (1,b) is a subgroup of G. **[7M]**

   (b) Find the number of integers between 1 and 250 both inclusive that are not divisible by any one of the integers 2, 3, 5 and 7. **[7M]**

MODULE – IV

5. (a) Find a formula for the general term of the Fibonacci sequence
   0, 1, 1, 2, 3, 5, 8, 13,..... **[7M]**
   (b) Solve the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + (n+1)2^n$. **[7M]**

6. (a) Solve the recurrence relation $a_n = 2(a_{n-1} - a_{n-2}); n \geq 2$ and $a_0 = 1$ and $a_1 = 4$. **[7M]**
   (b) Use the method of generating function to solve the recurrence relation
   $a_n = 4a_{n-1} + 3n.2^n; n \geq 1$ given that $a_0 = 4$. **[7M]**

MODULE – V

7. (a) Establish the isomorphism of the two graphs given in Figure 1 by considering their adjacency matrices. **[7M]**

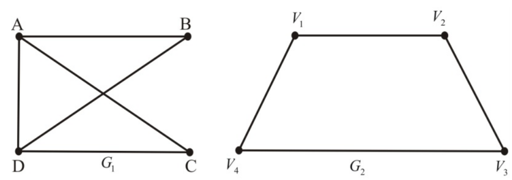

Figure 1

   (b) Use Prim's algorithm to find a minimum spanning tree for the weighted graph given in Figure 2. **[7M]**

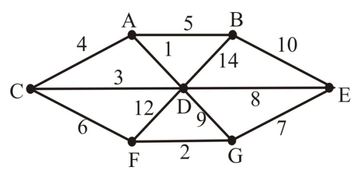

Figure 2

8. (a) Give an example of a graph which contains
   i) An Eulerian circuit that is also a Hamiltonian circuit that are distinct.
   ii) An Eulerian circuit and a Hamiltonian circuit that are distinct.
   iii) An Eulerian circuit but not a Hamiltonian circuit, a Hamiltonian circuit, but not an Eulerian circuit. **[7M]**
   (b) Use Kruskal's algorithm to find a minimum spanning tree for the weighted graph shown in Figure 3. **[7M]**

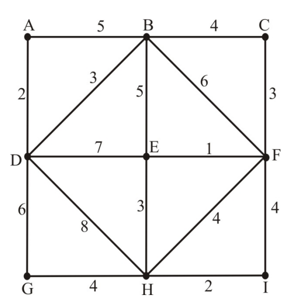

Figure 3

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